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Huntsville Center

# Ordnance • Explosives environment

*News From the Ordnance Center of Expertise and Design Center*

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## ISO 9000 standards applied to ordnance work

*by John Sikes, Quality Assurance Specialist (Ammunition Surveillance), Huntsville Center*

With ISO 9000 Implementation Training, the OE Team took its first step in June 1996 toward developing a quality management system that uses the guidelines and provisions of the International Organization for Standardization (ISO) 9000 series.

The ISO standard used by the OE Team is ISO 9001, which provides a model for quality assurance in design, development, production, installation, and servicing of a product. That standard historically has been used in the manufacturing world, but is also applicable to service industries, such as OE safety and engineering services. The requirements of ISO 9001 as stated in the standard "are primarily aimed at achieving customer satisfaction by preventing nonconformity at all stages from design through to servicing."

ISO 9001 requires that we document procedures for all areas of our operations affecting the quality of our OE response services. Among the 20 "elements" to be addressed are management responsibility for all processes affecting quality; determination of customer requirements; process consistency and control; contracting; personnel training; internal quality audits; and corrective and preventive actions.

In January 1997, the Safety and Quality Assurance Team began defining OE processes and developing procedures that would align our quality management system with the requirements of ISO 9001. Currently, 28 processes, called Ordnance and Explosives Quality Procedures (OEQP's), have been identified and documented. OEQP's define the "who, what, and why" of a process. In some cases, however, lower-level documents describing the detailed "how-to" of a given process are needed. Those documents are called Ordnance and Explosives Work Instructions (OEI), 25 of which have been approved for use.

Our OEQP's and OEI's consolidate applicable references, define team and individual responsibilities, required actions (procedural steps), and define the records generated for those activities performed by the OE Team. This quality management system is intended to be flexible, enabling us to incorporate new ideas, change or streamline procedures, and continuously improve. With documented procedures, we now have a baseline against which to measure performance. □

## Toxic Release Inventory reporting by CY2000

*by Michael Eck, U.S. Army Environmental Center*

In CY2000, Department of the Army installations will begin annually reporting toxic chemical releases from some ordnance activities, including open burning, open detonation, and other treatment and recycling, reuse, and recovery operations. The reporting will meet the requirements of the Emergency Planning and Community Right-to-Know Act—Toxics Release Inventory (EPCRA TRI).

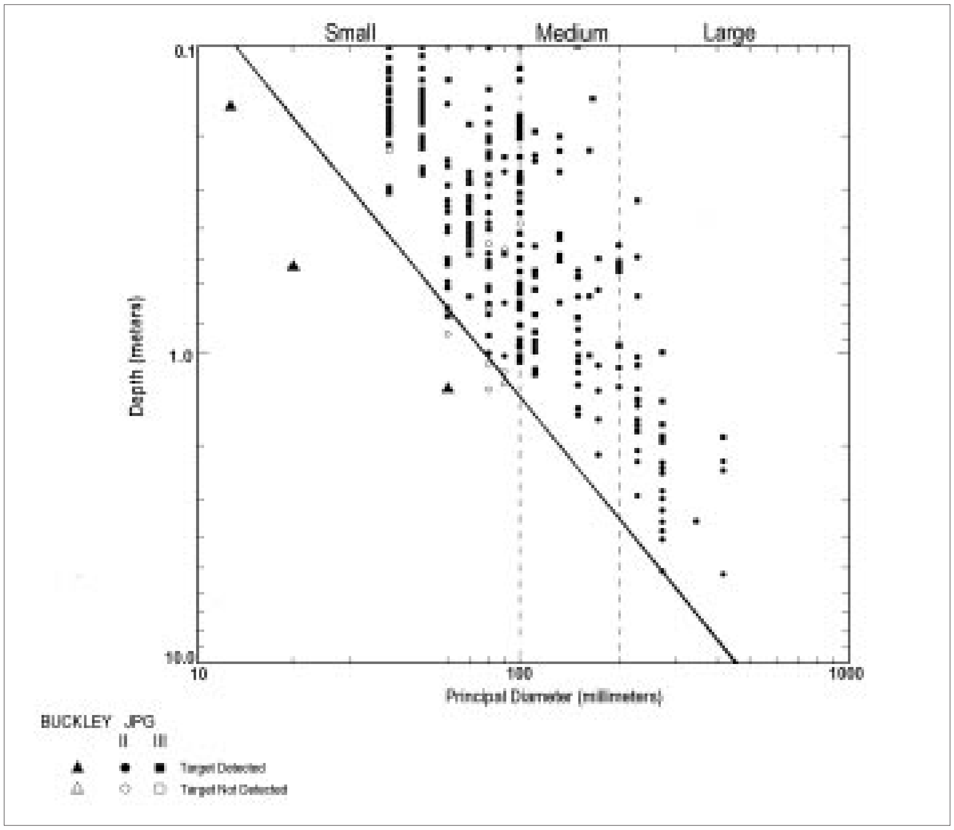
TRI is a publicly available data base that contains specific toxic chemical release and transfer information from manufacturing and Federal facilities throughout the United States. Each year, facilities report the amount of toxic chemicals released into the air, water, and land and the amount transferred off-site for treatment, disposal, recycling, or energy recovery. Facilities also provide identifying information, such as name, latitude and longitude, environmental permit numbers, and the destination of the hazardous waste transferred off-site. Installations should prepare during the coming year for the record keeping that will be necessary in 1999 for accurate reporting in 2000.

*EPCRA TRI continued on page 5*

# Geophysical mapping looks deeper

by Dr. John Potter, Huntsville Center

***Advanced analysis of combined geophysical data yields a 3-D map of underground anomalies, boosting detection capabilities beyond JPG results.***




The solid circles and squares represent ordnance items detected at Jefferson Proving Ground Phases II and III. The triangles represent the the deepest ordnance items found at Buckley where geophysical mapping was used. As the figure shows, geophysical mapping at former Buckley Field led to detection of items at depths beyond those demonstrated at JPG.

## Background

Traditional methods for locating buried ordnance have centered around unexploded ordnance (UXO) specialists equipped with hand-held metal detectors (usually magnetometers or "mags"). Sweep lanes are marked throughout a small area known as a grid (about 100 by 100 feet). The UXO specialists then walk each of those lanes, sweeping a magnetometer from side to side as they go and placing a small flag in the ground wherever the magnetometer suggests an ordnance item may be located. That process is often referred to as "mag and flag."

Mag and flag effectiveness varies widely, depending on specific site conditions, ordnance size and depth, the instrument used, and the experience and care of the individual UXO specialist. In evaluations at the Jefferson Proving Ground (JPG) Advanced Technology Demonstration (Phase I) and the former Buckley Field geophysical prove out, the effectiveness of mag and flag, in terms of the percentage of items detected, was on the order of 30% to 40% of the UXO present. The mag and flag method is also slow, labor intensive, does not provide a permanent record of subsurface conditions, and results are often not reproducible.

## New Technology

Many new techniques and technologies have been proposed and tested in an effort to improve detection performance. One basic element common to all of the most successful of those is digital geophysical mapping. Here, the digital data from the geophysical sensor is combined with positional survey or navigation information to develop a three-dimensional map of the characteristic that the sensor is measuring. Ordnance items (along with other debris and natural irregularities) show up as high and low points, or anomalies, on such site maps.

The geophysical mapping process capitalizes on the use of sensors with higher sensitivity, application of noise reduction techniques (real time and post processing), and advanced data-analysis techniques. With a data logging system, the user is no longer constrained to real-time decisions and selections (to place a flag or not to place a flag). Rather, the data stream can be enhanced and analyzed during post processing, and the experience of others can be brought to bear (for example, through expert systems). Furthermore, a permanent record is produced. In evaluations at JPG (Phases II and III) and at the Buckley geophysical prove out, detection efficiencies were on the order of 70% to 90% for single instrument systems. Systems with two or more instruments (now possible since location information enables co-registration of multiple data sets) have detected over 95% of the targets in test plots at JPG.

## Buckley Field Project Design

Based on the above-mentioned successes, the U.S. Army Engineering and Support Center, Huntsville chose digital geophysical mapping for the sampling needed to support the engineering evaluation/cost analysis for former Buckley Field. The geophysical mapping was supported by a team, with each team member bringing a critical skill to the project. The team consisted of a prime contractor, a geophysical

*Mapping* continued on page 6

# Diagnosing the earth

by Dr. I.J. Won

***The question of "where to dig?" plagues both the environmental and ordnance worlds. For both, geophysical tools are part of the answer.***

"How was the Grand Canyon formed?" goes the joke. After visiting a few messy environmental job sites where "remedial actions" were taking place, I came up with an answer: "An environmental contractor was looking for an abandoned underground storage tank."

When I was a kid in Korea, officials in my home town decided to punch a highway through a vast old graveyard. Descendants had to dig up their ancestors and move them to another cemetery. For years during the project, my friends and I walked through the pockmarked rolling hills, staring into open pits and playing on mounds of earth. That is, by the way, not dissimilar to what I see at some environmental remediation sites, except that those descendants knew where to dig.

Pits, trenches, dirt mounds, flattened vegetation: Must we mutilate the land in order to save it? That question relates to a paradox of modern technology. In this age of moon-landings, digitally reconstructed color photographs of the Martian surface, and satellite spy cameras that can supposedly read, at a distance of several thousand miles, the brand name on a cigarette pack, it may seem outright comical that we cannot tell where a utility pipe is without digging, how deep the ground water is without drilling, or even what is written behind this sheet of paper without flipping the page.

If we can see through a telescope a bursting galaxy billions of light years away, why is it that we cannot see an object covered by a sheet of paper or an underground storage tank covered by a foot of dirt? The secret resides, of course, in the medium that fills the space between viewer and object.

When the space is filled with anything but air, our visual images of the hidden object are severely blurred or simply not there. The interposed medium is opaque, and neither a high-powered astronomical telescope nor a spy satellite camera can see behind it. This opacity forces us to dig the earth and flip the page.

What do we do when faced with this maddening opacity? How do we find the fuel pipes, underground storage tanks, and burial trenches? The typical response has been to drill, dig, and cut away the opaque medium so that we can have an unobstructed view.

Just as medical doctors have access to remote sensing tools that enhance their performance and reduce risk, so do scientists and engineers. These are called "geophysical" tools, and those who use them and try to make sense out of the data collected by these tools are called geophysicists.

Despite their diversities, all geophysical tools are based on a few simple physical laws derived mostly from the classical physics of gravity, electricity, magnetism, and mechanics. Broadly speaking, they are grouped into two categories: active and passive sensors.

Active sensors emit something and see how the hidden objects react to it. Common examples may be a flashlight in the dark or traffic radar at an airport. Active geophysical methods include seismic, electromagnetic, ground-penetrating radar (GPR), and some types of electrical and radioactive surveys.

In passive methods, we attempt to sense something inherent in the object or indirectly measure some ambient field that is warped by a hidden object, as does a household infrared detector against an intruder or a chemical device that measures the ozone content in the atmosphere. Passive geophysical methods include gravity, magnetic, natural radioactivity, and some types of electrical surveys.

Let me briefly explain a few basic physical principles of those methods. Seismic and GPR sensors emit short acoustic or electromagnetic pulses and measure the echoes or other responses from objects hidden in the earth. In an electrical survey, we send galvanic currents into the earth through a pair of electrodes and measure voltages through another pair of electrodes implanted into the earth over a suspected object. The magnetic and gravity methods are passive because they measure how the existing earth's magnetic or gravity field is distorted by the presence of hidden objects. The earth's magnetic field is distorted near a ferrous object that has a higher magnetic susceptibility than its host medium. Similarly, earth's gravity is distorted by an object whose density is either higher or lower than its surroundings.

Performing geophysical surveys on Earth is analogous, in many ways, to performing medical diagnosis on a patient. Without any diagnosis of the earth, we risk performing unnecessary, even detrimental, surgery on our patient. As no reputable doctor would open up a patient without having performed all available diagnoses, we should not open up the earth without all available geophysical data. Otherwise, it's often too messy, damaging, and costly.

We should open the earth with an educated anticipation of what we may encounter. Geophysical data help us to guess, or to often to pinpoint, what may exist beneath the earth we are about to excavate. This is necessary so that we know what to expect before we open her up....So that we don't dig up a whole acre to find an underground storage tank....So that we may

***Diagnosing*** *continued on page* 7

# MTADS helps clear Badlands Bombing Range

*by J.R. McDonald, Naval Research Laboratory*

Figure 1. MTADS with the magnetometer array surveying Bull's-eye I on the Cuny Table. MTADS incorporates both cesium vapor, full-field magnetometers and active, pulsed induction sensors. The sensors are mounted as linear arrays on low-signature platforms that are towed over survey sites by an all-terrain vehicle.

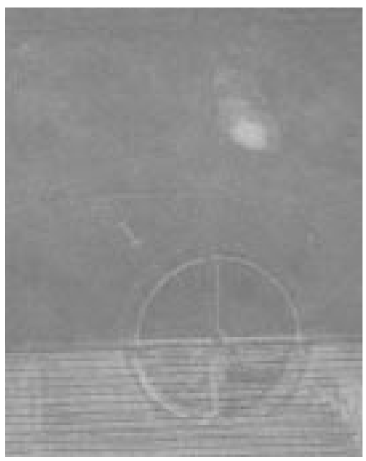


Figure 2. Aerial photograph of Bull's-eye I (500 feet in diameter) on the Cuny Table, Badlands Bombing Range.

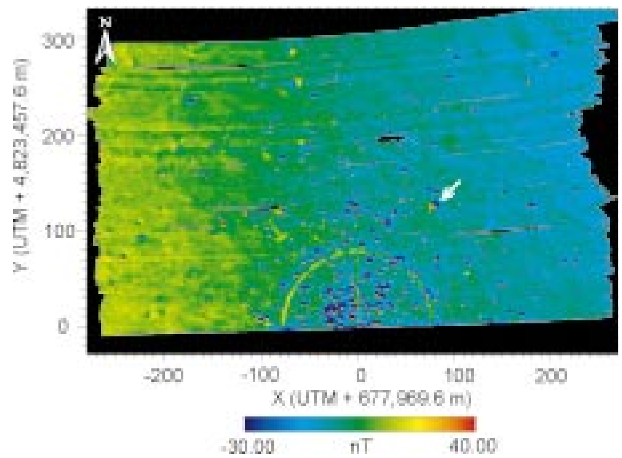



Figure 3. Magnetic anomaly image map of the north side of Bulls-eye I on the Cuny Table showing an outline of the target and the distribution of ordnance targets.

With support provided by the Environmental Security Technology Certification Program (ESTCP), scientists from the U.S. Naval Research Laboratory (NRL) conducted a survey of selected sites at the Badlands Bombing Range, South Dakota, using the Multi-sensor Towed Array Detection System (MTADS). During the 5-week operation in July and August of 1997, survey results were concurrently used by unexploded ordnance specialists from the Huntsville Center, U.S. Army Corps of Engineers, and ORDREM, Inc., a commercial ordnance removal firm, to clear portions of the surveyed land.

MTADS, shown in figure 1, incorporates both cesium vapor, full-field magnetometers and active, pulsed induction sensors. The sensors are mounted as linear arrays on low-signature platforms that are towed over survey sites by an all-terrain vehicle. The position-over-ground is plotted using state-of-the-art global positioning system technology, which also provides survey planning and vehicle guidance during surveys. Using mature sensor technology, NRL has focused on the development and integration of a data analysis system (DAS) to locate, identify, and categorize all military ordnance at its maximum probable self-burial depths. DAS is efficient and can be operated by relatively untrained personnel.

The sites selected by the Department of Defense for demonstrating MTADS were on the Pine Ridge Reservation in South Dakota. From 1942 until the late 1950's, this area was used for training, including bombing, aerial gunnery, and artillery exercises. Very limited documentation exists, however, as to where and what types of operations were conducted on the 341,383-acre range. Sites most beneficial to the Native American community were chosen for the demonstration.

Within about 60 hours of actual survey time, 145 acres of land encompassing two target areas were surveyed. The first area was a dirt-berm bull's-eye (a 500-foot diameter circle) still visible in aerial photographs (figure 2). The second survey area was a suspected target area indicated by surface clutter and faint images on old aerial photographs. Those areas were characterized by the MTADS magnetic and pulsed induction sensor platforms. Almost 1,600 targets were identified and analyzed by DAS. Figure 3 shows a gray scale presentation of the north half of target I. Of the analyzed targets on both bull's-eyes, about 420 targets were selected for excavation.

After DAS analyzation, a survey team flagged the predicted locations of the selected targets. The UXO teams were provided with localized magnetic anomaly image maps and a target dig list indicating the x-y positions of the targets and their pre-

Figure 4. Jeff Neece of Huntsville Center led the removal team that recovered this 250-pound, sand-filled M57. This target is indicated by the white arrow in figure 3.

dicted depths, sizes, and orientations. All selected targets, both large and small, were excavated to reveal the targets and verify their identities. At that point, the actual location of each target was again recorded before removal. The average discrepancy between predicted and actual locations was about 20 centimeters; depths were generally accurate to 20%.

Only forty of the 420 items selected for excavation were not ordnance related. Based upon the MTADS survey, eighty MK38 practice bombs and four 250-pound, sand-filled MK57 bombs were removed (figure 4). Some of those ordnance items had intact black-powder spotting charges, which were detonated by Corps UXO personnel. MTADS also located about fifty 2.25-inch and 2.75-inch rockets and numerous 2.75-inch rocket warheads. All other targets were identified as ordnance-related scrap. Figure 3 clearly shows the dense target field of large ordnance found by the magnetometer survey.

Over the last year, MTADS has successfully completed a series of technology demonstrations at test ranges, including NRL's Chesapeake Beach Detachment; the Marine Corps Air Ground Combat Center at Twentynine Palms, California; and Jefferson Proving Ground (JPG) in Madison, Indiana. In independently scored blind studies at JPG, following the JPG III commercial evaluations conducted in late 1996, results showed that MTADS performance exceeded that of commercially developed systems. Detection efficiency was about 96% with relatively low false alarm rates for all of the scenarios surveyed by MTADS.

The sites selected at Badlands Bombing Range had been previously cleared. The combination of mature sensor technologies, when coupled with modern Global Positioning System Information and the advanced DAS capabilities of the MTADS clearly demonstrates the potential of newer technologies in future removal activities. To further enhance the system's ability to discriminate ordnance items from non-ordnance and scrap, NRL, with support from ESTCP, is developing advanced data fusion and analysis techniques for the data collected by MTADS.

*Dr. McDonald is head of the Chemical Dynamics and Diagnostics Branch of the Chemistry Division at NRL. He has overseen the development and testing of state-of-the-art UXO detection instrumentation for more than 15 years. His e-mail address is j.mcdonald@nrl.navy.mil.* ☐

## EPCRA TRI *continued from page 1*

Not all chemicals associated with ordnance and not all ordnance activities must be reported. Reportable toxic chemicals include metals and metal compounds in casings and projectiles, such as lead; some energetics, such as nitroglycerin; and some volatile organic compounds released during combustion. Generally, for ordnance waste management and for recycling activities, reporting would be as follows:

- Treatment, disposal, or stabilization of ordnance declared a waste on-site is exempt. For example, if ordnance were declared a waste at an installation and transported from storage to open detonation on that installation, releases from that open detonation would not be reportable.
- Treatment, disposal, or stabilization of ordnance declared a waste at one installation and then treated or disposed of at another would be reportable. For example, if ordnance were declared a waste in accordance with the Military Munitions Rule at one installation and then transported to another for open detonation, then releases from the open detonation of that ordnance would be reportable.
- Releases from recycling and recovery of ordnance would be reportable.

Environmental and ordnance personnel will need to determine the ordnance identification (DODIC number), amount, and final disposition; pounds of each toxic chemical in each item as manufactured; and pounds of each toxic chemical released from each ordnance item during treatment, recycling, or recovery. The Services are developing tools to assist installations in estimating toxic chemical components and releases from ordnance. Those tools will be tested at DOD installations during Fall 1998. After testing, training will be provided for installations.

Government-owned, contractor-operated (GOCO) ammunition manufacturers

**EPCRA TRI** *continued on page 6*

## *Mapping* *continued from page 2*

contractor, a UXO contractor, a geographic information system (GIS) contractor, a surveying contractor , and Huntsville Center.

The specific sensor system was competitively selected using a geophysical prove out plot. There, various ordnance items (or simulated items) of the types and at the depths expected for the real site were buried in known locations in an area similar to the site. Then, systems representing the most successful of the participants from JPG were used to map the plot. The sensor system with the best combination of detection, false alarm, and production rates was chosen for production work.

In addition, several data enhancement techniques were employed. Data were screened to identify equipment malfunctions and data sets characterized by excessive noise. Then, each data set was processed to adjust for instrument bias, to remove background level, and to enhance anomaly signatures. Most of those processing algorithms were derived from Huntsville Center's Knowledge Base effort and applied by the project GIS contractor.

### Results by size and depth

The figure (page 2) shows a plot of ordnance size versus burial depth. The solid circles and squares show the items detected by all participants in JPG Phases II and III, respectively. The open circles and squares represent items not detected by any system. Ordnance items ranging from 40-millimeter grenades and submunitions to large bombs are represented in those data sets. Based on the pattern made by the circles and squares, a clear demarcation between detectable and undetectable items can be seen, as shown by the diagonal line. Above that line falls the area of state-of-the-art detection of ordnance for various sizes and depths, according to JPG results.

The solid triangles show the size and depth of the ordnance items actually identified and recovered at Buckley using geophysical mapping techniques. The three triangles represent a 0.50-caliber projectile, a 20-millimeter projectile, and a 3-pound MK23 practice bomb. Although other items were found, those triangles represent the deepest of each size. As the figure shows, digital geophysical mapping at Buckley has led to detection of ordnance items at depths beyond the limits demonstrated by the combined best efforts of JPG Advanced Technology Demonstration participants.

*Dr. Potter manages the Ordnance and Explosives (OE) Innovative Technology Program as part of the OE Center of Expertise for the U.S. Army Corps of Engineers. He serves as the Corps' OE Innovative Technology Advocate, charged with bringing the most appropriate new technologies to OE projects conducted by the Corps.* ☐

## *EPCRA TRI* *continued from page 5*

have been reporting to the EPCRA TRI since 1987. All other Federal facilities have been reporting since 1994, as directed by Executive Order 12856. DOD installations have reported TRI releases from the following activities: ammunition manufacturing, processing, and wastewater treatment at GOCO's; depot-level vehicle maintenance; and intermediate-level vehicle maintenance at troop installations. Most of the reporting DOD installations have been either depots or ammunition manufacturing plants. DOD installations, as a whole, have significantly reduced reported releases and transfers for treatment in the past three years by aggressive pollution prevention measures.

Under previous Environmental Protection Agency (EPA) and DOD EPCRA TRI reporting guidance, hazardous waste treatment activities, such as open detonation, were exempt from TRI reporting. DOD will soon issue TRI reporting guidance for ordnance treatment, disposal, recycling, recovery, and reuse activities. For GOCO's, reporting for treatment and disposal may begin sooner because of an EPA regulatory change last year. (For more information on that change known as EPCRA TRI Phase II, contact your environmental office.)

TRI data and uses are different from other ordnance data that DOD has submitted to Federal and State regulators to support the Resource Conservation and Recovery Act (RCRA) permitting process. RCRA reporting has been for components and emissions deemed hazardous under RCRA. TRI reporting concerns over 600 listed chemicals that EPA found toxic to humans. Toxic release estimates for TRI must be reported each year for the prior calendar year. The annual TRI report then is summarized by the EPA and provided free on the internet as a data base for further analysis. Recent projects using the TRI data include a comparison of Federal facility-reported releases against census data in order to screen for environmental justice concerns and the development of a computer program that provides relative oral and inhalation toxicity rankings of all reported TRI chemicals by site.

To ensure accurate reporting, installations should:

- Review record-keeping procedures for ordnance operations. Records should describe ordnance type, preferably by DODIC number; if the ordnance was declared a waste on-site or off-site; amount managed by round, pounds, or net explosive weight; final disposition; donor charge DODIC and amount; and amount of scrap metal recovered and recycled.
- Coordinate with installation environmental personnel to become familiar with EPCRA TRI reporting protocols in order to ensure that proper records are maintained.

*Michael Eck is an environmental engineer at U.S. Army Environmental Center. For questions concerning EPCRA TRI requirements, call him at 410-671-1227 or e-mail him at mkeck@aec2.apgea.army.mil.* ☐

# Institutional controls promote stakeholder involvement

*by Kim Speer, Huntsville Center PAO*

Institutional controls, in conjunction with ordnance and explosives (OE) response actions, are a means of reconciling land use and control with public safety through local and state authorities and stakeholder involvement.

In describing the development of institutional controls, Rob Wilcox, environmental engineer and project manager at Huntsville Center uses a preventive medicine metaphor when comparing institutional controls to removal actions. "An OE removal action is like surgery," says Wilcox. "In very serious circumstances, there may be an obvious and immediate need for an intrusive operation. But in situations that are not critical, alternatives can be considered and used."

If there are no readily apparent "symptoms," then using a measure that prevents a change may be the best approach. For instance, for a person whose family has a history of heart disease, a healthy life style or other preventive measures might be recommended. Institutional controls, which also depend on appropriate behavior, could be viewed as "preventive medicine" for ordnance response.

The use of public notices as an institutional control could be compared to a patient wearing a medic alert bracelet. Methods such as land-use restrictions are similar to restricting patient activity through casts, crutches, or bed rest. Generally, a full range of options are considered before recommending surgery. OE response actions, particularly removals, should be considered with similar caution.

The seriousness of an OE problem is based on the threat to public safety. Three factors are used to determine risks to the public: presence, access, and behavior. If an immediate removal response is not necessary, an engineering evaluation/cost analysis (EE/CA) is performed to evaluate the site and recommend future response actions.

"The problem with past recommendations for institutional controls is that they were not being presented as fully developed options. Recommending fencing or signs is not addressing the full scope of what is needed," says Wilcox.

With institutional controls, greater involvement from stakeholders is necessary because the focus is on access and behavior. "The problem with fences and signs stems from the Federal Government's lack of authority to enforce such remedies," says Wilcox. Although the Federal Government retains responsibility for OE at formerly used defense sites, State, local and private institutions exercise authority over the area itself. With the proper guidance, development, and implementation, however, local authorities could put in place enforcement strategies that are actually outside of the Federal Government's purview. By applying the same tools used to formulate the EE/CA (data collection and plan formulation), a sustainable method of institutional control could be proposed. However, coordination and planning with the local authorities are critical.

According to Wilcox, there are two OE sites where institutional controls have been developed as a recommended response action. While no decision has yet been made, Wilcox thinks there is a strong argument for their selection because of the extensive involvement made by the stakeholders during development. "One project site is already an isolated and protected area, and the stakeholders are not really receptive to removal actions because of conservation concerns. One stakeholder even suggested reforestation as part of an institutional controls alternative."

While large land areas with limited populations and active stakeholder involvement make access control a safe, viable institutional strategy, alternatives to removal are also being considered in more populated areas. "At one site with considerable urban development, coordination with the stakeholders has resulted in an institutional controls strategy that would rely on administrative requirements," Wilcox says. "Official notices would be required with all land-use transfers, and those would be provided through the local courthouse."

Administrative requirements and notices rely more on behavior modification, but limited presence and access also make this a safe alternative according to Wilcox. "We can never eliminate 100% of the risk, but we can respond with alternatives that greatly reduce the risk. Having the local authorities' support helps in that effort."

Wilcox also points out that, with many projects competing for limited OE clean-up dollars, institutional controls may offer, in some cases, an equally safe but more cost effective solution than traditional removal efforts. □

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***Diagnosing*** *continued from page 3*

look a little bit smarter to our client and may save a little bit of his money, which is often our tax money....So that we may keep the earth a little bit cleaner, a little bit safer, and a little bit more intact.

*Dr. Won is founder and president of Geophex, Ltd., Raleigh, NC, an environmental and geological consulting firm. He obtained a B.S. degree in mining and petroleum engineering from Seoul National University in Korea, and an M.S. and Ph.D. in geophysics from Columbia University in New York. From 1976 to 1989, he was professor of geophysics at North Carolina State University in Raleigh. He has published more than 40 research and review articles in refereed technical journals and books.* □

# Calendar of Events

- Twenty-eighth Department of Defense Explosives Safety Seminar and call for papers: Abstracts due March 23; seminar held August 18-20, Orlando. Call 703-325-1375; fax 703-325-6227; e-mail knoblettbr@ddesb.osd.mil.

- Third Symposium on Technology and the Mine Problem: April 6-9, Naval Postgraduate School, Monterey, CA. Call 703-550-8276; e-mail dmctod@aol.com.

- AeroSense—SPIE's 12th Annual International Symposium on Aerospace/Defense Sensing, Simulation, and Controls: April 13-17, Orlando. Call 360-676-3290; fax 360-647-1445.

- UXO Forum '98—the Fifth Global Conference on UXO: May 5-7, Annaheim, CA. Call 1-800-505-8827.

## OE Website

**http://www.hnd.usace.army.mil/oew/index.htm**

- Containment Structure Technology
- OE Policy Documents
- Business Opportunities
- OE Presentations
- OE Project Fact Sheets

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**Joan Burns 205-895-1766**

**Input Wanted!** What would you like to see in the OE Newsletter? Below, please list any topics that you would like to see covered. We are also seeking authors for feature articles. If you'd be interested in writing an article, please indicate the topic below and give us your name, organization, and work phone. FAX this page to 205-895-1798 or call 205-895-1778.

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